

pared to prior art hole configurations. The hole shape provides high coverage by flaring the hole to a large width (at the lobed portion) in the direction perpendicular to the streamwise flow. Then the area ratio across the hole is optimized to force uniform flow through the hole without separation, and to lay a highly effective film on the surface to be cooled without blow-off. This is accomplished by contracting the downstream side of the hole forward (FIG. 3) to optimize the diffusion within the hole, resulting in the bi-lobed shape.

[0036] One benefit with this configuration is that the bi-lobe shape forces flow to more uniformly fill the hole. Additionally, the amount of material need to be removed to create the hole shape is reduced, which results in decreased costs.

[0037] The present invention thus presents a unique shape for a cooling hole that lowers stress concentrations, and improves the ability of the rotor blade to withstand thermal stresses.

[0038] Although a preferred embodiment of this invention has been disclosed, a worker of ordinary skill in this art would recognize that certain modifications would come within the scope of this invention. For that reason, the following claims should be studied to determine the true scope and content of this invention.

What is claimed is:

1. A component for a gas turbine engine comprising: a component body having a first surface separated from a second surface by a thickness; and at least one cooling hole formed within said component body, said cooling hole defining a first opening to one of said first and second surfaces, said first opening having a bi-lobed shape.
2. The component according to claim 1 wherein said cooling hole defines a second opening to the other of said first and second surfaces, said second opening having a shape different than said bi-lobed shape.
3. The component according to claim 2 wherein said shape of said second opening is circular.
4. The component according to claim 1 wherein said first opening has a center of origin with said bi-lobed shape being defined by a first lobe extending to a first distal tip at a first radius extending from said center of origin, a second lobe extending to a second distal tip at a second radius extending from said center of origin, and an arcuate portion curving inwardly from said first and second distal tips toward a center portion closest to said center origin, said center portion being defined by a third radius extending from said center of origin, and wherein said first and said second radii are greater than said third radius.
5. The component according to claim 4 wherein said first opening defines a first cross-sectional area for said bi-lobed shape and wherein said cooling hole transitions into a second shape having a second cross-sectional area less than said first cross-sectional area.
6. The component according to claim 5 wherein said second shape extends to a second opening in the other of said first and second surfaces.
7. The component according to claim 5 wherein said second shape comprises a circle having a center point that defines said center of origin.
8. The component according to claim 7 wherein said bi-lobed shape is further defined by a base portion from which said first and said second lobes extend, said base

portion including a first segment defined by a fourth radius extending from said center of origin, a second segment on one side of said first segment defined by a fifth radius extending from said center of origin, and a third segment on an opposite side of said first segment defined by a sixth radius extending from said center of origin, and wherein said fourth, fifth, and sixth radii are less than said first and second radii.

9. The component according to claim 8 wherein said circle is defined by a seventh radius that is less than said first, said second, said third, said fourth, said fifth, and said sixth radii.

10. The component according to claim 1 wherein said component body comprises an airfoil having a curve with a leading edge and a trailing edge.

11. The component according to claim 10 wherein said bi-lobed shape includes a base portion having a first width and first and second lobes that extend radially outwardly from said base portion, said first and said second lobes extending away from each other to define a second width larger than said first width and that is orientated in a direction that is transverse to streamwise flow over said airfoil.

12. The component according to claim 1 wherein said bi-lobed shape comprises a first lobe of a first size and a second lobe of a second size different than said first size.

13. The component according to claim 1 wherein said first opening has a center of origin with said bi-lobed shape being defined by a plurality of radii that each extend from said center of origin.

14. A gas turbine engine comprising:

- a fan;
- a compressor;
- a combustion section;
- a turbine; and
- an airfoil associated with at least one of said fan, said compressor, said combustion section, and said turbine, said airfoil having a curve with a leading edge and a trailing edge, said airfoil including a first outer surface and a second outer surface separated from said first outer surface by a thickness, and said airfoil including at least one cooling hole formed within a body of said airfoil, said cooling hole defining a first opening to one of said first and second outer surfaces and a second opening to the other of said first and second outer surfaces, said first opening having a bi-lobed shape.

15. The gas turbine engine according to claim 14 wherein said turbine includes a plurality of blades, each blade including a platform with said airfoil extending outwardly of said platform, said airfoil having a pressure wall and a suction wall spaced from each other and connecting said leading and said trailing edges.

16. The gas turbine engine according to claim 14 wherein said bi-lobed shape is defined by a center of origin and a plurality of radii extending from said center of origin and includes at least a base portion, a first lobe extending from said base portion to a first distal tip, a second lobe extending from said base portion to a second distal tip, and an arcuate portion curving inwardly from said first and second distal tips toward said base portion, and wherein said first lobe is defined by a first radius extending from said center of origin, said second lobe is defined by a second radius extending from said center of origin, and said arcuate portion extends inwardly from each of said first and said second lobes